

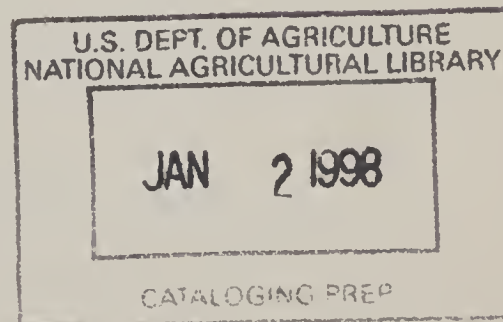
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Research and Data Needs for **LAND USE PLANNING**

A report prepared by the Basic Data and
Research Subgroup to the Committee on
Planning and Policy for Land Use and
Land Conservation



U.S. Department of Agriculture

Washington, D.C.

February 1974



DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

PREFACE

In recognition of the importance of using our resources wisely, on March 26, 1973, the Secretary of Agriculture established a Committee on Planning and Policy for Land Use and Land Conservation. To help carry out its functions, the Committee established a working group on basic data and research, and asked that it report on research and data needs for land use planning.

This document is the report of the working group to the Committee. It has been reproduced for circulation to other professional workers in the land use field, so that they too may have available the results of the working group's study. Their recommendations deserve careful consideration. However, they have not been a subject of policy-level review in USDA and should not necessarily be considered an official Departmental position.

Many people in USDA contributed to this effort. Primary responsibility, however, rested with the members of the subgroup: Melvin L. Cotner, Chairman, ERS; Arthur Newman, CSRS; Thomas Mills and Jay Hughes, FS; Ray Dideriksen, SCS; Clark Ison, ASCS; Carl Carlson, ARS; Thomas F. Hady, Roger Strohbehn and Robert C. Otte, ERS.

A limited number of copies of the report are available to interested individuals. Requests should be directed to Dr. Melvin L. Cotner, Director, Natural Resource Economics Division, ERS, USDA, Washington, D.C. 20250.

A handwritten signature in cursive script, reading "T. K. Cowden", is positioned above the typed name and title.

T. K. COWDEN
Counsellar to the Secretary
United States Department of Agriculture

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RESEARCH AND DATA NEEDS FOR LAND USE PLANNING

A report prepared by the Basic Data and Research Subgroup to the Committee on Planning and Policy for Land Use and Land Conservation

SUMMARY

The report:

- discusses land use research issues and data problems
- evaluates ongoing research and data systems
- suggests needed research and data approaches
- proposes early action activities relating to research and data development

Emerging land use research issues discussed are:

- changing demand for land to produce food and fiber needs
- land availability for food and fiber production
- competing uses of rural lands near cities
- restrictions on agricultural chemicals and sediment movement
- conflicting use of wetlands and floodplains
- aesthetic issues associated with clearcutting and mining
- solid waste and animal waste disposal on rural land

Land use data issues discussed concern:

- needs for geographic specific data for planning
- data systems to focus on planning problems
- flexible data dissemination capabilities

Research recommendations suggest studies that:

- emphasize land availability for competing uses in rural areas
- evaluate economic and environmental land use issues
- identify basic land capabilities and potential land use
- relate technology change to land use problems
- strengthen local, state, and regional land use planning processes and implementation problems

Basic data recommendations suggest that:

- a land use data classification scheme be developed
- automated land use data retrieval capability be implemented

Early action activities recommended are to:

- prepare and publish an annotated bibliography on land use research reports
- improve land use research classification and research retrieval
- conduct symposia on selected land use problems
- undertake a systematic survey of land data needs
- compile a "Citizens Guide to Land Use Planning" for rural areas.

RESEARCH AND DATA NEEDS FOR LAND USE PLANNING 1/

PERSPECTIVE

This report provides background on research issues and data problems relating to land use planning in the United States, and discusses existing land use research and USDA data systems. It presents recommendations for land use research, as well as data development and dissemination capabilities. Early action activities relating to research needs and the use of existing research also are discussed.

The report focuses on land use planning for agriculture and rural areas. Accordingly, it is not intended to be comprehensive in scope or coverage. It covers some research areas and data collection activities that are shared responsibilities with other agencies and institutions. Some of the recommendations and suggestions in the report must be considered tentative until further information becomes available.

Because land use and land use planning have both broad and narrow connotations, it is difficult to review and categorize research and data needs. For this report, land use research and data needs are defined as land use information that is directly useful to State and local planners and public decisionmakers. The intent is to circumscribe the problem area to manageable dimensions. As will be pointed out, additional work on land use research and data classification schemes is needed.

1/ Report prepared by the Basic Data and Research Subgroup for the Committee on Planning and Policy for Land Use and Land Conservation, U.S. Department of Agriculture.

LAND USE PLANNING PROBLEMS

Historically, land use planning has not been widely used as a means of guiding resource allocation decisions. Land use planning is frequently linked to land use control in the minds of many individual firms and property owners, who view it as a constraint on their resource use decisions. Property owners have been relatively free to pursue their own private objectives. The sum of these private decisions were expected to meet society's collective goals for the use of the Nation's land resources. However, greater population pressure, a more affluent society, the new environmental ethic, and growing awareness of the abuse of natural resources have helped formulate a new set of demands for the use of our land resources. These factors also underlie a growing awareness of the interdependent nature of private resource use decisions, and of the public consequences of those decisions. Land use planning is now being viewed in a new light--as a vehicle for guiding the rate and location of urban expansion into rural areas, while minimizing the loss of individual decisionmaking prerogatives.

The limited attention given to land use planning in the past has resulted in a correspondingly small research effort toward land use planning problems. Research has been mostly directed toward urban planning, including some attention to problems associated with rural-urban transition areas. Water and related land resource planning, a second type of planning, has stimulated a considerable amount of research and numerous resource inventory studies. These studies may provide significant insight and guidance into the general principles of planning, as well as useful resource data for planners.

Land use is receiving new and changing emphasis in the United States. There is increased concern for the services and amenities provided by natural resources. We are still concerned with the products and materials that can be harvested or are embedded in the resource base; but other resource uses, such as recreation, wildlife, open space, and other environmental needs, are now given more weight in planning and evaluation. Moreover, the manner in which resources are used is coming under scrutiny. The offsite effects of resource use practices on the Nation's health, general well-being, and safety are being questioned. As population increases and as economic activity grows and becomes more concentrated, there will be increased pressure to plan and control resource use and to develop policies for dealing with these issues. We must improve our capability to plan and evaluate programs designed to conserve, develop, and protect our resources. The following paragraphs highlight some of the problems and research issues relating to resource use. The discussion provides a partial framework for identifying land use planning research and data needs.

Research Issues and Concerns

Changing Demands for Food and Fiber Production--Until recently, we have been concerned during the past two decades with insufficient demand and oversupply of agricultural products. A USDA publication of the early 1950's, called "The Fifth Plate," discussed the ability of U.S. agriculture to meet the Nation's food and fiber needs in view of the expected population increase. That "Fifth Plate" was filled to overflowing; within a few years, we were more concerned with disposal of surpluses than with merely meeting the demand. More recently, the rate of population growth has dropped, as

reflected in lower population projections by the Bureau of the Census. As recently as 5 years ago, the Department's projections of food and fiber production were based on Census Series B projections of population. In 1968, Census Series C was used to reflect the decreasing birth rate. And now we are using Series E, which projects a U.S. population of 224.1 million in 1980 and 264.4 million in 2000. Also, there is a great deal of talk about a zero population growth rate (ZPG); that is, a situation where the changes in population due to births, deaths, and net migration result in no change in the total population number.

A stable population would dampen the rising demand for food and fiber and, in turn, the need for agricultural land.

Of course, population changes are not the only factor affecting the demand for food. Changes in consumer income and preferences also must be considered. As incomes have risen over time, consumers have upgraded their diets and have eaten more animal protein and less of the high-calorie, low-protein foods. These changes are reflected in land use.

In the last several months, changes in world demand and the export market have been reflected here at home. Sales of wheat and feed grains, shortages of protein in several major producing areas, dollar devaluation, and a general upgrading in consumer demand in the more affluent foreign countries have increased our export markets. In the long run, a sustained increase in export demand could change our land use significantly.

Planners at all levels need information on the prospective demands on the Nation's land resources. They need information on likely production patterns and potentials, as well as estimates of needed product quality and market locations. Coupled with land productivity data, land needs for food and fiber production can be estimated.

Land Availability and Potential--This Nation has been fortunate in having an abundance of land for agricultural and other uses. Part of the good fortune, however, is the result of rapid adoption of new technology in farm production. Fertilizer, improved crop varieties, and more productive strains of livestock have been important factors in increasing the yields per acre and per animal unit over the years. Perhaps even more important are the management skills of U.S. farmers. The upward trend in productivity per unit of input is expected to continue. These trends, along with availability of other suitable land that could be brought into production, suggest that the food and fiber supply potential of our land resource is sizable.

Improvements in farm production technology have more than offset the net loss of agricultural land to other uses so that, in effect, the economic supply of land for agricultural purposes has increased. For this reason, the withdrawal or conversion of about 1 million acres of agricultural land to nonagricultural uses each year has had little effect on the aggregate output of agricultural goods and services. However, we do not know the cumulative, long-term impact of such land use changes.

Large regional shifts have occurred in cropland acreage. Over a 20-year period following World War II (1944-64), cropland acreage in the United States declined nearly 27 million acres. This was the net change.

Nearly 54 million acres of cropland was abandoned, mostly in the South and East. About half of the loss was offset by new land development in Florida and the Mississippi Delta, and in irrigated areas. The potential for further regional adjustments has not been assessed.

Land use for agriculture has not been central to the current interest regarding national land use policy, but the amount and importance of such land is considerable. And, the current rise in export demand suggests that either more land or increased application of technology to existing agricultural land is needed. Experience in the diversion of farmland to and from other uses indicates we should give more attention to this land in considering national land use policy. Information is needed on land availability and future land productivity in order to properly identify land needs for food and fiber production. Information is needed on local and regional comparative advantages of land resources in the several regions.

A related issue concerns the large and increasing amount of land supporting vegetation commonly called brush. Nearly 300 million acres are classified as "brushland". Some of this land supports other kinds of vegetation such as grasses or trees that are useful to mankind. Protection from wildfire and heavy livestock use has permitted the expansion of "brushland" acreage in recent decades. The availability and productivity of cropland and pasture have diminished. "Brushland" serves as wildlife habitat and brush vegetation is a large consumptive user of water. Information is needed which will facilitate brush management activities that are compatible with both livestock, wildlife, and water resource management objectives. Such information would be useful in developing land use plans.

Competing Uses For Land--One of the main areas of emerging land use planning issues is the environs of our metropolitan growth centers. Here exists a multitude of quality-of-life issues, including open space and recreation needs, transportation, and skip or leap-frog development. In addition, there are a whole set of impacts on the rural economy associated with unplanned urban encroachment. These include urban development of productive agricultural land, isolation of farming enterprises, speculative idling of land with associated high real estate taxes, the presence of unsightly sanitary landfills and automobile graveyards, and various other land use incompatibilities.

Most of the U.S. population growth occurs in the ²⁶⁴~~233~~ Standard Metropolitan Statistical Areas (SMSA's). During the last decade, total SMSA population increased by 20 million people. The net increase for the United States as

a whole was 24 million people. The SMSA's now account for about 70 percent of the people but only an eighth of the land area. A considerable amount of agriculture and much open space is found in these SMSA's. Most of the SMSA population (89 percent) occupied only 10 percent of the area, for an average density of five persons per acre. In the remaining 90 percent of the SMSA area, there was only one person to each 16 acres.

Rural portions of the SMSA's--the rural-urban interface--make up the transitional zone for land use changes that greatly affect our quality of life. However, the problem is not a shortage of land but rather, effective land use planning and control, and coordinated planning to provide adequate public services and facilities. Planning and control can guide the spatial distribution of economic activities and the timing of public development activities.

In these rural portions of the SMSA's, half of the land is still in farms and half of the farmland still produces crops. In 1969, the SMSA farms accounted for 14 percent of all U.S. cropland harvested, 60 percent of all vegetables sold, 43 percent of all fruit and nuts sold, 27 percent of dairy income, and 24 percent of poultry income. In these areas the problem on one hand is maintaining agricultural production and, on the other, providing land for living, recreation, and open space for an expanding urban population. The uses may be complementary rather than competitive. Planners and decisionmakers need information for planning and implementing plans at the rural-urban interface.

Land Needs for Rural Development--In 1971, farming provided only about 11 percent of the earnings of persons employed outside SMSA's--less than half the 26 percent provided by manufacturing jobs. Furthermore, passage of the Rural Development Act of 1972 underscored the national policy of stimulating the development of job opportunities in rural America. Development of nonfarm business in rural areas will mean that rural people will face many of the same issues--reconciling the conflicting uses of land. Expansion of employment in new or existing rural towns may result in increased demand for farmland for residential development, expansion of business and commercial activities into formerly agricultural areas, and similar problems. Effective development of rural areas may require planning on a multicounty scale, as well as difficult decisions to locate industries in certain parts of the areas and have workers commute from other places. All of these issues will raise new problems for nonmetropolitan local government and those responsible for land use planning.

Energy Conversion and Land Use--Our highly complex economy, including the agricultural sector, has been based on relatively cheap power. Cutbacks in the amount of energy available, or sharp increases in the price, could affect our whole way of life, and with it the use of our land. Agricultural land use could be regulated to insure the efficient use of energy in farm production.

Professor Borgstrom, at Michigan State University, has done a great deal of research on the relationships between energy expended and energy produced in various forms of food and fiber production. His research shows that farm crops and livestock generally produce much less food energy than is used in their production. Depending on the type of farming, three to five calories

of energy may be used to produce one calorie of food energy. Stored energy from fossil fuels makes up the difference. Our modern mechanized farms depend much more heavily on this stored energy than did farms of a generation ago when draft horses, mules, and human labor supplied more of the energy input. In those days, about 40 million acres of our farmland were used just to produce feed for the draft animals. Mechanization has made farms more efficient in terms of labor use, but in terms of energy use they are relatively inefficient.

Although our modern agriculture depends on fossil fuel, agriculture accounts for a very small share of the Nation's total use. In 1969, farmers used about 6 billion gallons of petroleum fuel--about 3 percent of all petroleum used in the United States. Similarly, farmers use a very small share of the Nation's electric power. Thus, the energy crisis obviously cannot be solved by reducing fuel supplies to farmers. But, attempts to improve the conversion of stored energy to food energy may influence the amount of land required to meet food and fiber needs.

Restrictions on Agricultural Chemicals--The environmental movement can affect agriculture in several ways. One way is the restriction of certain inputs, such as pesticides and fertilizer. Recent ERS studies show the effects of pesticide controls on the yields and costs of producing specific crops. Controls on application of commercial fertilizer have been proposed but have not been enacted. Restrictions on the use of pesticides and commercial fertilizers would tend to lower both yields and quality of product, and to increase production costs. If we are to maintain farm production in the face of these restrictions, more land will be used--possibly land that

is more difficult to manage. In the past, farmers have turned to pesticides and fertilizers because they were less costly than land. Restrictions could slow down or even reverse this trend. On the other hand, research could develop safe substitutes or safe uses for the restricted pesticides. We need information on the effect of these restrictions on land use.

Use of Wetlands and Flood Plains--According to USDA's Conservation Needs Inventory, 265 million acres of private and Federal cropland have an excess of water and internal moisture problems, which limits their suitability for cultivation and other uses. This acreage is scattered mostly through the eastern half of the country, but is largely concentrated in the Delta and northern Lake States and along the southeastern coast. From 1944 to 1964, about 2.6 million acres of land were reclaimed for cropland use in Florida and the Delta. Large acreages of this class of land remain for reclamation or other natural uses. There is concern that draining and dredging activities on lands with excess surface water result in a net loss in ecological values by upsetting the natural balance. Wetlands and flood plains are important to the wildlife resource. The impact from draining and dredging must be weighed against the growing need for land for such uses as recreation, crop production, and mining.

Flood control programs have various impacts on land use. Water impoundments flood the land and change the ecological balance, but they also permit agricultural use of land and often create permanent water areas for fish, wildlife, and recreation. Flood control sometimes raises stream levels and causes stream-bank erosion. Conversely, it often stabilizes stream flow and reduces stream-bank erosion. The trade-offs between development needs and environmental concerns will influence decisions on land use. Planners need information on the expected land needs for drainage development, as well as flood protection.

Timber Harvesting--Timber can be harvested by a number of alternative methods, each having its associated advantages and disadvantages. Choice of a particular method should be based upon the physical and biological conditions present and the trade-offs between various forest land management goals, including goals relating to financial and aesthetic factors. Removal of all the timber from large blocks of land is often the only practical way to perpetuate forests of commercially desirable species that have high requirements for light. Such large block cutting is sometimes considered aesthetically undesirable, however. If improperly applied on unsuitable sites, it may cause erosion and stream sedimentation. Alternative harvesting methods, where only part of the timber is removed, favors reproduction of more shade-tolerant species. Which of these methods is most desirable depends upon the mix of management goals entertained, the biological and physical conditions, and the productive capacity of the particular site.

Animal Waste Disposal--Animal wastes are an environmental and land use problem because of the huge amounts produced, because animals are increasingly found at central production facilities, and because the wastes pollute air as well as water. Animal production results in 2 billion tons of waste annually; a third of this is liquid. This volume far exceeds the volume of waste from other sources. When agriculture was more widely dispersed, animal waste was a minor problem; it was returned to the land as fertilizer. An increasing proportion of the waste now comes from central points--feedlots holding more than 100,000 animals, and poultry operations involving more than 250,000 birds. A cattle feedlot of 10,000 head produces 260 tons of manure a day. Manure that finds its way into streams is a serious pollutant

because of its high biological oxygen demand. Economic factors limit the distance manure can be hauled to spread on the land. If manure is spread on frozen ground, it reaches water courses through surface movement; legal restrictions are being considered that will preclude this practice.

Potential air and water pollution from animal wastes may cause livestock and poultry industries to locate away from populated centers. More information is needed on waste disposition and utilization, including the recycling of animal waste in animal feed. Decisionmakers need information on the potential for relocating facilities, as well as methods for minimizing environmental problems.

Solid Waste Disposal--Residential, commercial, and institutional solid waste amounts to some 250 million tons a year. About 190 million tons, or nearly 1 ton per person, are collected each year. Three-fourths of this waste goes into 14,000 open dumps. With an average size of 34 acres these dumps occupy a total land area of 476,000 acres. Three-fourths of the dumps are classed as unsightly, and 57 percent are in areas of active agriculture. The visual impact is much greater than the area indicates because the dumps are scattered, and hence affect large areas. At the present rate of filling, about 500 new dumping sites will be needed each year. This is in addition to other unsightly uses of rural land, such as automobile graveyards that mar the landscape. Planners need information on how to include landfills and related waste disposal facilities in their land use plans.

Sedimentation--The sediment load in our waterways is at troublesome levels because it causes silt problems, carries plant nutrients that cause eutrophication, and contaminates our drinking water. As much as 1 billion tons of sediment is carried by U.S. rivers to the ocean. About half of the sediment

is estimated to come from cropland. Sediment is a serious problem not only because of deposition in streams but also because of the loss of topsoil from our cropland base. Research indicates that soil loss is excessive on about a third of our cropland. In time, erosion will seriously impair the land's productivity. Many conservation practices have been adopted to deter erosion; but in many cases, these practices are not profitable for the farmer as an individual. Regulation of land use to control sediment could result in marked changes in cropping patterns and production practices, particularly on sloping lands. Information on the effects of sediment regulations and financial incentives on land use is needed to guide land use planners.

Surface Mining--The impact of mining on the rural environment is causing increasing concern because of the mounting problem of slag heaps from pit mining, and particularly because of the rapid increase in surface mining of coal. About 600 million tons of coal are produced annually in the United States. Surface mining now accounts for more than a third of the total, and is gaining because of economic and safety factors. In addition to serious pollution effects, such as acid mine drainage into streams, about 2 million acres of rural land have been disturbed, creating unsightly scars that visually affect much greater areas. Because of our increasing need for energy and because we have such huge coal reserves relative to other energy sources, rural acreage disturbed by surface mining could total 5 million acres by 1980, and may involve an area equal in size to the State of Maryland by 2000. With adequate information, the land use problems associated with surface mining can be minimized.

Recreation and Open Space Needs--The U.S. standard of living has risen considerably in recent years. With it has come an increasing demand for leisure-time activities, including recreation in rural areas. Over a billion visits to public areas were made in 1965--about half to Federal land and half to State and county land. This number does not include visits to local areas, which were largely in urban locations; and it does not include the billion visits to the 132,000 private recreation areas. Huge rural acreages are involved in recreation--447 million in Federal, 40 million in State, and 3 million in county public areas. The number of visits to these public areas increased 50 percent from 1960 to 1965. It is projected that, by the year 2000, the demand will be about three times the present level.

Open space in urban areas is receiving increasing emphasis and attention as a necessary factor in the well-being of people living in congested areas. It can be provided by small parks, recreation areas, or simply vacant land between buildings. Most agricultural activities are compatible with open space uses of land. Land use planning decisions should include provisions for recreation and open space.

Second Homes Development--Various problems have their origin in the rapidly increasing sales of rural parcels of land mainly for second homes or recreation purposes. By 1965, about 2 million second homes had been constructed. Pure water supply and hygienic waste disposal are serious problems in some areas because of isolation and scattering of developments. Rural parcel sales have increased greatly, particularly in recreation areas

or within commuting distance of population centers. Many parcels are held merely for speculative purposes. To a large extent, there has been little pre-planning in consideration of environmental impact or service needs of the developments such as water and sewer requirements.

Data Needs

Physical and Biological Data--The preceding land use problems and associated land use planning issues imply a pressing need for information on basic resources--soil, geologic materials, water, and vegetative cover, as well as land use productivity levels. Basic data are needed for direct use in planning, and also for land use research to support planning. Information is needed on the extent, location, and quality of land and water resources, including subsurface resources and climatic characteristics. Data on use potential and conservation needs would help in planning for uses that will maintain the quality of the land. Much of the inventory data should be monitored periodically.

In most instances, physical and biological land use planning data should be geographic specific. For instance, soils information must be site specific to help in locating septic systems. Forest use plans depend on site specific information on tree species and quality. In some instances, physical and biological data can be generalized for large areas such as sections, counties, resource regions, and States.

Social, Economic, and Institutional Data--Physical and biological data has little use for land planning purposes unless it can be linked with the socioeconomic parameters associated with planning. If researchers and planners are to evaluate prospective land uses and requirements, they need

information in the following categories: The number, location, and characteristics of the population; ownership, tenure, and use of resources; land improvement measures; farm management practices; fertilizer response of crops; production statistics; and resource laws and regulations that will influence land use planning.

Much of the socioeconomic data are reported as averages or totals for geographic areas. In most instances, the more general economic data can be correlated with the site specific physical and biological data. However, data systems must be developed with the user in mind. For instance, determinations of cropland availability depend on a compatible system of information on soils, their location, current use impediments to cultivation, costs of development, and the operator's probable decision regarding future land use.

Appraisal of Current Land Use Research

The Current Research Information System (CRIS) and the Smithsonian Science Information Exchange (SSIE) were used for this report to identify research studies currently underway that would serve land use planners. A classification scheme was devised to identify different types of information and analyses that might be useful. The classification system includes: (1) Base studies and projections; (2) alternatives and potentials; and (3) planning and institutional arrangements. Specific topics within these categories are shown in table 1. Many research studies address two or more topics; however, the classification system provides a general overview of the relative emphasis of current research on these topics.

Table 1--Land use research as reported in the USDA Current Research Information System and the Smithsonian Science Information Exchange, FY 72

Research categories	USDA - CRIS			SSIE
	Projects	Funds	Researchers	Projects
	<u>Number</u>	<u>Mil. dol.</u>	<u>SMY ^{1/}</u>	<u>Number</u>
Base studies and projections on land:				
Spatial distribution	44	1.2	30.8	58
Soil suitability	45	1.1	16.3	42
Capability and productivity	146	3.1	48.4	0
Current and projected use	126	6.2	104.1	28
Ownership and institutions	57	1.0	26.1	3
Total	418	12.6	225.7	131
Alternatives and potentials for land use:				
Competing demands	101	1.7	37.7	31
Alternative uses	183	2.5	53.5	59
Conservation needs	38	0.4	12.1	18
Spatial dimension	10	0.1	2.5	2
Total	332	4.7	105.8	110
Planning and institutional arrangements:				
Revenue base and taxation	68	0.9	21.7	1
Control measures	41	0.6	16.6	10
Planning process	90	1.7	35.6	42
Program alternatives	18	0.5	7.9	2
Total	217	3.7	81.8	55
Grand total	967	21.0	413.3	296

^{1/} Scientist man-years.

The CRIS and SSIE documentation schemes are not fully comparable. SSIE documentation does not always identify scientist man-year (SMY) efforts. Therefore, the research listing of land use projects is not well defined or complete. Nevertheless, a review of the listing indicates the relative emphasis of ongoing work and the general level of funding. In general, the search identified nearly 1,300 projects closely related to land use planning. SSIE documentation did not identify funding levels. Based on the USDA report, total funding for studies of use to planners probably exceeded \$25 million and involved some 500 SMY's in 1972 (table 1). In general, this estimate tends to overstate the ongoing work directly related to land use. Although much of the research reviewed was pertinent to land use planning, it was undertaken for other purposes. Accordingly, parts of the research identified may be of limited use to land use planners. A general appraisal of the ongoing land use research follows. A more detailed appraisal of the CRIS and SSIE projects appears in Appendix A..

Base Studies and Projections--More than half of the FY-72 land use research identified is classified as base studies and projections. They describe resource conditions, quality, and availability, as well as current and estimated future uses of land. A large portion of the work is devoted to resource use studies, especially forest surveys and projections.

Soil suitability studies relate primarily to work on the physical and chemical properties of soils, with some emphasis on the relationship of land use to resources. About half of the land use studies deal with the suitability of resources for a variety of land planning purposes, including cropland, forestry, urban, and transportation uses. Also, many of the studies relate to small areas or parts of States; there apparently is no national coverage.

Studies of current and projected land use emphasize forest and agricultural land uses. Recreation and urban use studies are also prevalent. Some studies are nationwide; others are oriented to counties, multicounty regions, and States. Little emphasis has been given to evaluating the projected impact of technological change on land use.

Over a fourth of the land productivity studies relate to the capabilities of forest land and a third relate to the recreation potential of land. About a fourth pertain to the capability and productivity of agricultural land. However, the retrieval of projects on agricultural land productivity is believed to be incomplete. Only a few studies are addressed to the productive capacity of rangelands and wildlife habitats. One study involves several States, but most of the studies cover a State or part of a State.

Landownership surveys are underway in a few States. Also underway are ownership surveys of lake property, woodlands, and seasonal home developments. Several studies deal with water rights, pricing, and use. Studies on landownership and institutional arrangements have fairly good geographic coverage but subject matter is thin and spotty, particularly for landownership.

Alternatives and Potential--Less than a fourth of the FY-72 studies classified as land use research relate to the analysis of land use alternatives and potentials. Studies in this category compare the demand for land for various uses, measure the impact of alternate potential uses, and evaluate conservation and land improvement investments. Most of the work is underway at Land Grant Universities.

Land demand studies cover a broad range of subjects, including urban uses of rural land, agricultural development and use, reclamation of strip mined land, and use of the coastal zone. Heavy emphasis is placed on recreation demand projects. Studies also focus on demands for land around intersections of interstate highways, disposal sites for municipal wastes, and development around reservoirs. There seems to be no systematic assessment of the total competing demands for land in specified localities, States, or regions. Current studies tend to be limited to a partial analysis of one or two land use alternatives.

Studies designed to analyze potential economic and environmental uses center primarily on estimating the output, employment, and income effects of specific land uses--such as forestry, farming, recreation enterprises, second home developments, and environmental activities. A few studies examine a wide range of alternative land use activities to determine the economic growth potential of a specific area. Several forestry studies measure both economic and environmental effects of alternative multiple use and land management strategies. There appears to be little research on evaluating the tradeoffs between competing uses, especially between economic and environmental consequences.

Most of the conservation studies are designed to determine the effects of conservation measures on runoff, erosion, and water quality. Pastures and forests are evaluated for use as land cover. There seems to be little emphasis on conservation measures for urban areas, range lands, and transportation corridors. Little emphasis is placed on regional studies.

Planning and Institutional Arrangements--About a fifth of the land use research is devoted to questions on procedures and institutional arrangements relating to the land use planning. Research is designed to evaluate and improve planning procedures and land use control measures, as well as organizational approaches and devices for land use planning implementation. The total effort is about equally divided between in-house USDA programs and those at Land Grant Universities.

Revenue base and taxation research focuses primarily on the broader problem of financing adequate levels of local government services in rural areas. Some work is directed toward the general problem of the impact and economic effects of property taxes on agriculture and forestry. Only a small amount of work is devoted to the analysis of differential assessment. Several studies relate to the revenue-producing capacity of recreation developments, forest industries, and other resource based developments.

Land use control research covers studies of land use patterns, particularly at the rural-urban interface; control measures, with emphasis on preferential taxation; water laws; outdoor recreation; and forestry management. Only a few studies are devoted to zoning, easements, or other land use control devices. Research in this area seems to be oriented to the Eastern United States except for recreation research, which is concentrated in the Mountain States and the West. The research relates almost entirely to State or smaller area problems. There appears to be little analysis of Federal powers or policy options.

Most of the studies relating to the planning process are oriented to area economic development through land use and water planning. Much of the work underway is addressed directly to improving land use planning

procedures. Several studies are designed to improve soils interpretation for planning, develop techniques for measuring environmental effects, and plan for recreation uses. Procedures for measuring economic consequences of alternative plans are well developed. Little attention has been given to techniques for measuring economic effects or to incorporate citizen participation in the planning process.

Only relatively small effort has been expended on evaluation of land use programs. Much of the research is devoted to economic problems in the management of water and watersheds. Studies are underway on the role of forests in open space planning, changes in forest ecosystems, public and corporate timber policy, land retirement programs, farm estate planning, and policies affecting the use and management of range resources. One study of note is a national environmental model of agricultural policy, land use, and water quality. No work was identified on the development of State approaches in implementing land use policy. Little emphasis is given to studies to determine the public's interest in important decisions and actions regarding land use.

Appraisal of Land Use Data and Data Delivery Systems

Numerous agencies within USDA collect data pertinent to land use planning. The Department's Office of Information Systems (OIS) has undertaken the role of collecting a list of data gathered or used by USDA agencies. Descriptions of data sources contain a title, key words, an abstract, and parameters relating to the geographic scope, frequency, collecting agency, and type of accessibility. Only the descriptive information is handled by OIS; the data are retrieved from the gathering agency. Data file descriptions

drawn from OIS's land use planning and related areas are classified as shown in table 2. The scheme is not how land use planning should be classified; rather, it is a classification that fits existing OIS data file information. A brief review of the data appraisal is discussed here. Appendix B provides a more detailed appraisal.

Data pertaining to existing resource conditions vary considerably in extent. Information on soils and their distribution is about 52 percent complete for the Nation. Most of it is on non-Federal lands. Similar information is generally lacking for Federal and urban lands. Data concerning water, on the other hand, are only available for selected sites and most of the information must be retrieved manually from unpublished sources. Water data are lacking for many locations and for such things as the impact of various land uses on water quality. Relatively detailed, published data on the timber resource are available for many areas in the Nation. Automated geographic detail can be retrieved for some regions. Data are available on the location and size of Federal recreation facilities. Several sources provide data on the effects of air pollution on forest trees. Similar information is lacking on other vegetative covers.

Considerable basic resource data are available. Problems occur in some areas because of incomplete coverage, or a lack of enough keying variables to tie alternative uses together and to tie resource information and research results to data bases.

Table 2--Classification of selected data on land use, USDA

Resources conditions

- Soil
- Water
- Timber
- Recreation
- Pollution
- Wetlands
- Surface mining

Production and marketing situations for land-derived commodities.

- Crop production, consumption, marketing, and prices
- Livestock production and marketing
- Wood production
- Recreation use

Financial conditions of land-based enterprises

- Farm tax and debt information
- Farm labor characteristics and other input costs
- Farm real estate values and revenue
- Farm enterprise characteristics

Public program formulation and extent

- Data helpful for farm program development
- Nature of credit programs
- Nature of various types of direct assistance programs

Data concerning land-derived commodities relate mostly to crop and livestock production. Product detail is well covered in both categories. Data are available on commodity consumption and inventories, often in monthly series showing considerable geographic detail. Information on forest products is available on a State basis; annual data are available for major products. Recreation use of National Forest lands has been quite thoroughly covered. Similar data on the recreation services provided by the private sector are lacking.

A large amount of financial information is available on farming enterprises. Data include such things as tax levels and the debt situation of farm operators. Characteristics of the farm labor market and data on farm real estate values are available, as are general data on the tenure of farm operators and the legal structure of the farm enterprise. Data files on production and marketing relate mostly to the farm sector. For example, data on credit and tenure of forest landowners are lacking.

Data are available on public credit programs, including interest rates, credit distribution methods, borrowers, profiles, and the purposes of loans. Some data have been collected on the scope of direct assistance programs for land and waste conservation, forest recreation, wildlife improvement, and community planning.

There is considerable variability in the Department's data retrieval systems. The range spans from customized automated retrieval to data stored in agency files that must be manually retrieved, sometimes from widely scattered field offices.

Most of the completed soil surveys are published and some are available through automated retrieval systems. Water data are usually available manually from agency files. Timber data are available from published sources and some can be retrieved through automated systems. Recreation data are available only through automated retrieval systems and are not published. Most of the data on production and product prices are published in considerable detail, but are not available through the automated systems.

Retrieval of data concerning the financial condition of farms varies. Roughly half of the data sets are available in published form and a few are automated. A large number, roughly half, must be manually retrieved from agency files. Problems with data retrieval are even more apparent for data more directly related to land use planning (see table 1). Some data are published, but many of them are available only from agency files. In many cases, several field offices must be contacted.

The ease of data retrieval greatly affects dissemination of information. Mass distribution of published data probably is the most effective communication means. However, if data users are aware of the scope and nature of the system, an automated retrieval scheme has greater flexibility. Users must be aware, however, of the nature of the automated system if it is to be fully utilized.

Considerable time and money has been expended in collecting basic land resource data within the Department. Some of the data are well suited to direct input into the land use planning decisions. Some are location specific. However, much of the data have limited value for the land use planner. Some were collected without the benefit of standardized accuracy and classification guidelines.

Data often cannot be readily compared across State boundaries. Similarly, some are not identified by key linkage parameters necessary for effective use. Some that would be useful in land use planning are not easily retrieved.

Recommendations for Research

Recommendations for additional land use research are based on the nature and distribution of the ongoing work reported in the USDA CRIS system and the projects identified in the Smithsonian SIE system. No attempt was made in this analysis to systematically review the existing literature concerning land use planning and policy. Research suggestions rely heavily on the judgment of members of the Basic Data and Research Subgroup and their knowledge of available research information. Review comments of colleagues within USDA are incorporated in this paper. Even so, this draft should be considered incomplete until a more comprehensive bibliography of research and research needs can be developed. These shortcomings are discussed in the section on proposed early actions.

Research needs are articulated herein in the context of land use problems or issues. Research needs are not specified in terms of physical, biological, or social sciences, or by disciplines. Each problem implies a mix of research by disciplines; some problems may require multidisciplinary research. Similarly, research needs are not identified by agency or distribution responsibility. Although this report deals primarily with agricultural and rural land use problems, the Subgroup recognizes that research on these topics may be undertaken in other agencies.

Base Studies and Projections--Empirical studies are needed at both the national and State levels to identify the location and quality of land that has unique characteristics for specific uses such as vineyards, citrus groves, minerals, and wetlands for wildlife habitat. Related studies also are needed to determine the type and location of lands that would be available for agricultural and forestry uses under various product price assumptions. Research is needed on the factors influencing the availability of land in the future, if economic demand or other forces dictate certain land uses.

Studies are needed on the alternative futures to project the economic and environmental demands that will be placed on land use under different assumptions relating to population, consumption patterns, resource development, international export markets, and public goals for environmental amenities. There is need for more information on the economic-environmental impact trade-offs that are implied with alternative land use patterns, reflecting emphasis on economic versus environmental uses. Particular attention should be addressed to problems arising from differences in demands between private citizens, local public interest groups, and national interest groups in the use and products obtained from land in various localities. Studies are especially needed to determine the current extent of second home/recreation developments in rural areas, and to project future trends of this type of "urban" land use; distinction should be made between lots bought for speculation and lots to be built upon in the near future.

Alternative and Potential Land Uses--Additional studies should be undertaken to evaluate competing demands for land, and identify uses that are compatible with the physical characteristics of the land and with neighboring uses. Research would include examination of rural and urban

land uses, transportation, energy generation and distribution, rural industrialization, surface mining, solid waste disposal, land as a consumption good, land parcellation, recreation uses, open space, environmental-development competition, and possible trade-offs between population dispersal and programs to achieve more intensive occupancy and use of land. Basic information is needed to interpret land capabilities and the economic and environmental consequences of alternative land uses.

There is need to assess the effect of new technology on both the supply and demand for land. Technology that increases agricultural output has the effect of increasing the supply of land. Other technology, such as improved transportation systems and new recreation vehicles, increase the demand for land.

The interrelations between energy development and land use need to be analyzed. Energy development, as it affects the economic and environmental impacts on local areas, should be evaluated. Related studies would consider reclamation of strip mined lands to convert them to useful agricultural or forestry uses, while improving the scenic quality of the strip mined area. Particular attention needs to be directed toward the emerging problems of the Northern Great Plains.

Public actions to improve the environment can have significant impacts on the way lands are used and managed. Additional research is needed to measure the economic impacts and land use implications of potential restrictions on agricultural operations such as pesticide applications, fertilizer applications, and sediment control.

Planning and Institutional Arrangements--Land use planning and implementation of plans implies public action to influence and guide private resource use decisions. Research is needed to strengthen the studies on land use planning, and show how comprehensive land use plans can be formulated and implemented. More specifically, studies should be undertaken to identify the different types of problems confronting local communities, State agencies, regional commissions, and the Federal Government that are to be resolved through "land use planning"; devise systematic planning process models that incorporate the multiple objectives of groups with diverse interests; devise local community decision models and institutions to facilitate implementation of selected plans; and evaluate alternative arrangements for coordinating land use decisions between different levels of governments.

Research is also needed on the institutional barriers to achieving efficient and socially desirable patterns of land use. Alternative institutional arrangements for resolving land use conflicts and achieving desired land use patterns should be evaluated. Studies should cover differential and deferred tax schemes and regulations, guidelines, and incentive programs to achieve public objectives related to erosion-sediment management, wetland management, waste disposal, surface mining, reclamation, and open space.

Information is needed on how ownership patterns, contracts, and other legal devices affect land use and resource distribution. Also needed are investigations of possible changes in the rights of private property owners as they relate to the public interest, including analyses of public property rights exercised through planning, zoning, and the exercise of the spending power of government.

Recommendations for Data and Data Delivery Systems

Data needs for land use planning cover a wide variety of information, as discussed previously in this report. An intensive investigation of data needs versus data availability was not undertaken. Some gaps, however, are

identified in Appendix B. Recommendations of this report focus on activities that USDA agencies could pursue to improve the collection of data for planning, and also to improve the accessibility of USDA data to planners at all levels of government.

Priority Data Needs--A special survey of land use planners is needed. It should identify specific information not presently available that precludes planners from preparing well-documented land use plans. The Soil Conservation Service (SCS) and the United States Geological Survey (USGS) have conducted inquiries with State and local government offices to obtain lists of land resource data needs. The response was about as expected--users of resource data wanted information on almost any imaginable data element relating to the resource per se, its use, and how use is controlled. Data collection costs are substantial, however; so some priority system for unfilled data needs should be developed from the OIS, SCS, and USGS experience. It is essential that the survey be conducted within the framework of a data classification scheme; and instead of an open-ended request for useful data, the question should be asked, "Which data items are unavailable and in what priority should they be obtained?"

High priority should be given to constructing a classification scheme for data relevant to land use planning. This scheme should then be used in the OIS system. The review of OIS data files revealed that a considerable amount of land-use related data is available. The major problem is the difficulty of selecting data that are significant in land use planning. The data files were very broadly classified according to USDA Missions and Goals,

which provides little help in discerning land use related data. The existing data files are almost impossible to interpret without placing them first in some relatively detailed classification scheme.

Many other Federal agencies, the USGS in particular, are currently involved in developing a land-use classification system. The current USGS effort is described in Geological Survey Circular 671 entitled, "A Land-Use Classification System for Use with Remote-Sensor Data." It describes land cover that can be sensed. Many States are working in the same area. It is essential that USDA agencies support a national land-use data classification system that fulfills the needs of most users. This will permit correlation of resource data and direct interchange of data between agencies, once a system is completed. Table 3 suggests one data classification.

Data file abstracts now in the OIS system should be refined, standardized, and cross classified to permit easy identification of data available for land use planning. Many data file abstracts are so brief they are meaningful only to people already familiar with the subject area. Thus, there is a corresponding need to develop a file system that would permit retrieval of data by major resource categories, as shown in table 3.

Data Delivery Systems--An effort should be made by all USDA agencies to achieve an automated data retrieval capability. The systems should be designed to be useful and accessible to State and local agencies and groups involved in land use planning. This effort should be accomplished in conjunction with an effort to communicate the nature and extent of USDA data. If an automated system is not fully implemented, a more standardized and less detailed published series probably would be the most effective way to provide data to land use planners.

Table 3--Outline for basic resource data categories ^{1/}

Physical		:	Social	:	Economic	:	Institutional
Biotic	Nonbiotic	:		:		:	
1. Vegetation:	1. Air:		1. Educational:		1. Income		1. Ownership and administration
- Cropland	- Sediment in air		- Available		2. Land taxes		2. Land availability
- Pasture	- Odor		- Needed		3. Resource program funding		3. Ordinances, controls, and regulations
- Forest			- Potential		4. Land use		4. Special purpose districts
- Unique plant community	2. Water:		2. Cultural:		5. Credit		5. Resource programs
- Orchard and vineyards	- Supply from snow		- Same		6. Markets		6. Other institutional resources (management, technology)
- Others	- Irrigation water developed		3. Service:		7. Prices		
	- Surface area and volume		- Same		8. Crop production		
2. Domestic Animals:	- Groundwater aquifers		4. Health:				
- Beef	- Water use		- Same				
- Dairy	- Quality:		5. Work:				
- Poultry	Sediment, BOD, temp., coliform, chemicals, TSS, etc.		- Same				
- Others			6. Recreational:				
3. Fish:			- Same				
- Rare and endangered species			7. Population:				
	3. Land:		- Rural				
4. Wildlife:	- Soils		- Urban				
- Rare and endangered species	- Amount of chemicals applied to land		- SMSA				
	- Prime and unique farmland		- Other				
	- Topography (landscape)						
	- Erosion and deposition						
	- Flood plains and associated data						
	- Ground water recharge areas						
	- River basin and subbasin						
	- Surface mined area						
	- Unique habitats						
	- Wilderness areas						
	- Wetlands						

^{1/} Kind, amount, and location of data needed, where applicable.

(continued)

Table 3 (Continued)

	Physical	:	Social	:	Economic	:	Institutional
Biotic	Nonbiotic	:		:		:	

4. Nonvegetative cover:

(Works and structures):

- Urban and built-up areas
- Service corridors
- Archeological and historic sites

5. Climate:

- Rainfall, temp., frost-free days, and other
- Hurricane occurrence areas
- Tornado occurrence areas

6. Geology:

- Stratigraphy of surficial deposits
- Minerals
- Fault lines
- Volcano occurrence areas
- Seismic data

A publication should be compiled and distributed to planners that describes the nature and source of land-use related data available from USDA agencies. The report should also indicate data accessibility, as well as procedures for retrieval. OIS is currently preparing for publication the data file abstracts submitted by each agency. Separate publications will be prepared for several subject-matter areas, as well as a subject-matter cross classification. Distribution of these publications, however, is currently intended to be restricted to USDA agencies and Land Grant University Libraries.

Possible Early Action Activities

Many of the recommendations for land use research and data development suggest long-term efforts; the results may be one or more years in development. Certain interim or early-action activities relating to research and data seem appropriate if USDA is to emphasize and support land use planning. Such actions should enhance subsequent research, as well as current planning.

The suggestions that follow are listed without implication of priority. Some items will require considerable time and resources.

Land Use Bibliography--An annotated bibliography of research reports useful in land use planning should be undertaken. There is a considerable body of literature on land use. In this report, only current research was reviewed; even then, only the objectives of the research were covered. Planners and researchers alike would benefit from a comprehensive listing and summary of land use reports. The National Agricultural Library conceivably could undertake this work.

Land Use Research Classification and Retrieval Systems--The CRIS and SSIE systems do not fully meet the needs for retrieving and identifying land use research. A classification system should be developed in conjunction with planners, researchers, and managers of the CRIS and the SSIE programs. This will be useful in interpreting as well as retrieving research information. Lead responsibility for this activity might be given to the managers of the CRIS program.

Symposia on Selected Land Use Planning Problems--The Soil Conservation Society conducted a national symposium on land use planning in 1972. There is need for follow-up on that effort, with additional conferences to focus on one or more specific land use planning problems identified in this report--such as competition for land, energy and resource development problems, environment-growth issues, and planning procedures and approaches. The conferences would, among other things, facilitate exchange of existing knowledge and identify specific problems and research needs. The conferences would involve researchers, planners, and agency program leaders. They could be jointly sponsored and planned by university and USDA staff. Other Federal agencies might be asked to cooperate.

A Systematic Survey of Resource Data for Land Use Planning--The Office of Land and Water Planning in the Department of the Interior has held meetings in selected States concerning land use planning data needs. Others also have queried needs, but not on a systematic basis and with undefined results. Respondents apparently do not articulate specific data needs. A survey structured and designed to identify existing data uses and data requirements for specific future planning efforts should be undertaken. Planners,

researchers, and program leaders at all levels should be surveyed. Coupled with the survey should be an effort to develop a resource data classification scheme--one that would provide a structure for the Department's land use data programs. Lead responsibility for a survey of this type could be assigned to OIS, with assistance from other USDA agencies. The Department of the Interior and other departments might also participate.

A Publication, "Citizens' Guide to Land Use Planning" for Rural Areas--

The Rockefeller Brothers Fund Task Force has prepared a document on a policy guide for urban growth that is receiving wide recognition. Additional materials focusing on agriculture and rural areas should be developed to identify the need for planning in rural areas, show how plans are developed, and suggest how citizens can participate in the planning process. The reports could outline specific steps for utilizing data capabilities and technical assistance from USDA and other agencies. Responsibilities for this work could be assigned in various ways, either through a task force of agency representatives or by giving responsibility to a lead agency.

Appendix A

Appraisal of Current Research Related to Land Use Planning 1/

The information in Appendix A is based on the examination of projects obtained from the Current Research Information System (CRIS) and from the Smithsonian Science Information Exchange (SSIE). For CRIS, all projects in Research Problem Areas (RPAs) 101, 104, 108, 110, 113, 902, 903, 907, and 908 and additional ones obtained by a keyword search were examined. The SSIE search excluded projects that were available through CRIS.

There is no sharp distinction between research and basic data activities. Research on categories 1A-Spatial Distribution of Physical Resources, 1B-Suitability of Soils for Alternative Use, and 1C-Land Use Capabilities and Productivity, done by the State Agricultural Experiment Stations, ARS, ERS, and FS, is discussed in the following section. Fully comparable work of SCS on these topics is reported in the Basic Data section. No work of SCS is included in CRIS.

1/ Footnote attached

1/ All of the research projects in the following CRIS Research Problem Areas were evaluated for relevance to land use planning:

- 101 Appraisal of Soil Resources
- 104 Alternative Uses of Land
- 108 Economic and Legal Problems in Management of Water and Watersheds
- 110 Appraisal of Forest and Range Resources
- 113 Remote Sensing
- 902 Outdoor Recreation
- 903 Multiple Use Potential of Forest Land and Evaluation of Forestry Programs
- 907 Improved Income Opportunities in Rural Communities
- 908 Improvement of Rural Community Institutions and Services

All other RPA's and the SSIE were searched on a keyword basis.

1. Baseline Information and Projections of Land Use

A. Spatial Distribution of Physical Resources

(CRIS: 44 projects, \$1.2 million, 30.8 SMY)
(SSIE: 58 projects)

There are two principal kinds of studies conducted in this category. The first is "production-type" inventory and analysis on a broad scale, such as an individual State, and exemplified by the soil survey. The second is broadly, "techniques research," aimed at developing new inventory and analysis procedures. Development and testing of remote sensing technology is a major component of this latter category. Soils, minerals, and water resources receive the major attention, with relatively little attention given to baseline studies of animal populations or "natural" vegetation other than forests.

All of these studies provide a spectrum of background resource information for land use planning. However, relatively few attempts were made to identify specific land use planning questions to which the research is directed, although such questions are obviously implied in all studies.

Explicit land use planning questions need added emphasis in baseline studies.

B. Suitability of Soils for Alternative Uses

(CRIS: 45 projects, \$1.1 million, 16.3 SMY)
(SSIE: 42 projects)

There are 87 studies underway to provide information and establish relationships between physical resources and land use. Over 30 percent provide maps, inventories, or interpretations that can be used directly for land use planning of a specific area, region, or a State; however, most of the studies are oriented toward evaluating techniques for gathering data, testing the physical and chemical properties of soils and geological materials, and determining the causes and effects of land use changes on the physical resources. Sixteen studies involve testing and evaluating remote sensing techniques for gathering resource data. Thirty studies include the suitability of soils and geological resources as a prime objective, and several of these are designed to test the validity of interpretations for land use planning, to aid in the selection of alternative

uses, and/or determine the socioeconomic impact in overcoming resource limitations. Five studies are directed toward solid and liquid waste disposal and the potential hazards to land, surface water, and ground water. About ten are transportation studies for a specific town, city, or highway corridor.

The studies cover a variety of land uses but most (30 percent) are related to the rural-urban setting. Nearly 25 percent relate to cropland and forestry uses of land; however, only one pertains to rangeland. Four studies involve the recreational uses of land.

Several projects have statewide application but most are for a small part of a State or an area with unique soil or geological conditions.

Additional studies are needed on the effects of waste disposal on lands and possible effect on surface and subsurface water supplies. More information is needed on the costs involved in overcoming soil and other physical limitations of land.

C. Land Use Capabilities and Productivity

(CRIS: 146 projects, \$3.1 million, 48.4 \$MY)
(SSIE: no projects)

There are 146 studies underway to provide information on land use capabilities and productivity. The studies cover a wide range, including determination of yield and productivity of lands used for crop production (dryland and irrigated), forestry, range, and wildlife; social-psychological-economic evaluations relating to goals, motivation, supply, and demand; cost-benefit ratios; environmental values; user preference; interpretations of the effects of land use practices, diseases, and insect infestations on productivity; program management of forest lands; prediction models for potential yields and the use of land; and ecosystem analysis for optimum resource use. About 20 studies have direct application to land use planning, and organize physiographic land patterns into a system having significance to forest managers. Most of the studies involve developing procedures, analyzing and testing relationships, exploring problems, determining influencing factors, and evaluating methods for measuring resource capabilities. About six of these latter studies utilize remote sensing techniques.

Over one-fourth of the studies relate to the capabilities and productivity of forest lands and one-third relate to recreational use, needs, potential and value of land. About one-tenth of the studies pertain to the capabilities and productivity of agricultural lands. Only a few studies are addressed to the productive

capacity of rangeland and wildlife habitats. One project involves several States but most studies are for a State or a subdivision of a State.

More data are needed on soil productivity and indices used to measure productivity. Other studies are needed to guide assessors in developing a fair and equitable revenue base for urban-fringe areas.

D. Current and Projected Land Use

(CRIS: 126 projects; \$6.2 million, 104.1 SMY)
(SSIE: 28 projects)

Baseline studies of present and projected land uses tend to emphasize agricultural and forested land uses. Although crop and livestock production are frequently featured, recreation as a land use and tourism as a corollary activity have received major attention. Urbanization and its potential impact on rural land use are also featured. Some studies are nationwide in extent, while many more are oriented toward individual counties, States, and multi-county regions.

Many studies deal with techniques for inventorying present uses and projecting future use. These frequently relate to specific land use planning questions and include individual project evaluation questions.

A possible weakness in listed research is the apparent relative lack of explicit evaluation of technological change upon land use.

E. Ownership Patterns and Existing Institutional Arrangements

(CRIS: 57 projects, \$1.0 million, 26.1 SMY)
(SSIE: 3 projects)

The work covers land ownership surveys in a few States plus other ownership studies relating to lake property, nonindustrial forest and small woodlot management and ownership, and seasonal homes. Several studies deal with water rights, and water pricing and use. Several sociological studies of attitudes are included. Recreational studies are largely technical and do not appear to contribute to baseline information. Geographic coverage appears fairly even overall but is thin and spotty by subject matter.

The criticism to both geographic and problem coverage is the scarcity of research, particularly for land ownership. This is one area in which States probably have a comparative advantage in data collection.

2. Land Use Alternatives and Potentials

A. Competing Uses of Land for Products and Services

(CRIS: 101 projects, \$1.7 million, 37.7 SMY)
(SSIE: 31 projects)

A wide variety of studies are underway to provide information and insights into the demand for products and services from land. These studies cover a broad range including urban uses of rural land, agricultural development and use, reclamation of strip mined land, and use of coastal zone lands. Heavy emphasis is currently placed on recreation demand. One-third of the studies are designed specifically to aid the planning process and two-thirds provide information useful to planners as a by-product or secondary purpose of the study. Most of the studies are confined to relatively small local areas (5-10 counties). A few are intended to provide generalizations at the State level and none seek to analyze the demand for land on a regional or national level. The studies, however, are widely scattered across the nation.

Non-USDA/Land Grant University sponsored projects primarily focus on demands for land around intersections of interstate highways; urban land uses, including disposal sites for municipal wastes; and land use patterns in the vicinity of surface water reservoirs. Most of the studies examine either (1) how a development program or project will affect land use or (2) how various land uses will affect water quality of streams and lakes. The geographic scope of the projects tends to be limited to specific local or substate areas. The limited number of studies underway and the diversity of topics addressed does not enable meaningful statements about the geographic dispersion of projects across the nation. Only one-sixth of the projects are designed to be of direct service to planners. The remainder of the projects, to some extent, appear capable of providing useful background information and insights into how various programs influence land use decisions.

A major gap in research on competing land uses is the lack of systematic assessment of the total competing demands for land in specified localities, States and regions. Current studies tend to be limited to a partial analysis for examining only one or two land use alternatives. Additional studies are also needed on rural-urban land use transition problems in populous areas to guide planners in determining the proper location and density of urban land uses.

B. Alternative Potential Economic and Environmental Use of Land

(CRIS: 183 projects, \$2.5 million, 53.5 SMY)
(SSIE: 59 projects)

Studies conducted in this category center primarily on estimating output, employment and/or income effects of specific land uses, such as forestry and farming enterprises, recreation, and second homes. Some studies are designed to measure environmental effects, including wildlife habitat, of man's economic activities. A few studies aim to examine a complete range of alternative land use or economic enterprises to determine the economic growth potential of the specified area. Several forestry studies seek to measure both economic and environmental effects of alternative multiple-use land management strategies. Only one-fifth of the studies are directed toward resource planning. Most of the other studies will provide essential information to planners even though the primary audience is resource managers. Over half of the studies provide information at the **State** level, while an additional one-third are limited to local area or substate problems.

Most non-USDA/Land Grant University studies focus on estuarine management problems, i.e., the effects of population density and economic activity in and near estuarine areas on the ecosystem of the area. Some studies focus on land use problems of storm water run-off from urban land and the utilization of land for disposal of municipal/industrial wastes. Several studies are underway to develop means of applying remote sensing techniques to inventorying and monitoring land uses and resource conditions. About 40 percent of the studies are directed toward resource planning problems. Half of the studies are limited to local or substate areas, while only one-third provide generalizations of resource management strategies at the regional or national level.

Ample studies appear to be underway to provide general information about the alternative uses of land. Greater attention, however, should be placed on evaluating the trade-offs between competing uses, especially between economic and environmental consequences.

C. Conservation Needs and Land Improvement Measures

(CRIS: 38 projects, \$0.4 million, 12.1 SMY)
(SSIE: 18 projects)

Most of the studies are designed to determine the effect of conservation measures on runoff, erosion, and water quality for land covers and uses such as pasture, forest, recreation, strip mines, irrigation, and rural-urban areas. Four studies relate to transportation

development. The transportation studies for selected towns in Missouri, the inventories of recreational needs for Idaho and North Dakota, and the data in the long-range plan for agriculture in the Four Corners Region of Utah provide information that can be directly used in land use planning of those selected areas. Most of the studies provide supplemental information that is useful in evaluating alternative conservation measures.

Some gaps occur in the conservation needs and land improvement category. Additional studies are needed on conservation measures for urban land, rangeland, and transportation corridors. More studies should be based on natural resource boundaries. It would be desirable to have more regional studies.

D. Spatial Distribution of Land Use Activities

(CRIS: 10 projects, \$0.1 million, 2.5 SMY)
(SSIE: 2 projects)

Spatial analysis, per se, was found in relatively few projects; although many projects deal implicitly with the spatial consequences of land use. Remote sensing, for example, provides raw data for spatial analysis, but this is seldom featured in remote sensing studies.

None of the projects had a national scope. Generally, the work was related to resource use within a State or region or river basin. A few of the studies were mainly conceptual with no specific geo-political base.

All of these projects were linked directly to land use planning questions.

Generally, it would seem that this is a relatively weak component of USDA-related research, and a reflection of the minimal role of USDA in this field.

3. Land Use Planning and Alternative Institutional Approaches

A. Revenue Base and Taxation Policies

(CRIS: 68 projects, \$0.9 million, 21.7 SMY)
(SSIE: 1 project)

Work in this area includes a number of types of projects. A few projects, aggregating about 1 SMY, are directed toward the general problem of the impact and economic effects of property taxes on agriculture. A little less than 3 SMY's are devoted to analyses of differential assessment of agricultural land in the various States. As described in the CRIS statements, these projects are

quite broad both in geographic and in subject matter coverage. They appear to address most of the relevant questions including the effects of differential assessment on land use. One possible deficiency is a lack of consideration in most of the projects on the problems of intergrading differential assessment with other tools designed to influence land use. Another group of studies, comprising less than 2 SMY's, seem basically designed to provide support for the assessment function. They include various studies of assessment-sales ratios, use of soil data in assessment, and similar questions.

A large group of studies, amounting to nearly 8 SMY's, are concerned with the broader problems of financing and providing adequate levels of local government services in rural areas. These include analyses of alternative tax structures, appraisals of existing and alternative institutional arrangements for providing public services in rural areas, research on the measure of State and local government facilities, services, and finances, and similar work. The studies are widespread in their geographic coverage. Certain areas of subject matter, such as research on cost functions for government services, seem inadequately covered.

Four projects, aggregating approximately 2 SMY's, consider forest taxation. These studies, and nearly all of the studies described above, are by nature more likely to be useful to State legislators who are determining the shape of State and local governmental institutions than they are to the local planner who must ordinarily take these as given.

A second large group of projects classes in category 3a includes general studies of economic development in specific parts of the United States. These studies range from broad studies of regional rural development potentials to studies of a much more specific nature, such as forest industry in Louisiana. The studies included in this category seem to be very inadequate as a means of support for rural development efforts but there are probably many other studies which are not classified as contributing to land use planning.

A final group of 16 studies, 4.6 SMY's, are in the general field of recreational development. They consider such subjects as the effects of a park on the rural economy, the economic importance of recreation to Kentucky farmers, implications of seasonal homes, snowmobile impacts, and expenditures of the Utah tourists. As a group they appear to be the most likely of the studies of this nature to be of use to the planners at the local level but are likely to be less useful to the State legislators trying to integrate recreation with other alternative uses for land throughout his State. Potential complementarities and conflicts between recreation and alternative land uses, for example, are not included.

Only one SIE project is included in this category; it is a study of intrametropolitan migration, public finance, and property values.

B. Land Use Control Measures to Implement Plans

(CRIS: 41 projects, \$0.6 million, 16.6 SMY)
(SSIE: 10 projects)

Current projects on land use control measures include studies of land use patterns, particularly at the rural-urban interface; control measures with emphasis on preferential taxation; water laws; outdoor recreation; forestry management. Geographic coverage is very spotty. The land use studies are concentrated mainly in the Northeastern United States, presumably because these States have been most active in passing preferential assessment laws and other land-use control measures (the distribution also reflects the influence of a strong regional research project in the area). Geographic coverage is very thin in the South and West.

Land use problems focus largely on preferential assessment, with only a few studies of zoning, easements, or other control devices. Focus of the outdoor recreation studies is not clear but tend to be technical studies, as do the forestry studies. Apparent usefulness of studies to planners is probably highest for studies of land use patterns.

The SSIE studies are more varied. They include two studies of the effect of highway interchanges on land use, and two studies of water management to reduce soil erosion and use of water and sewer line extensions as policy tools. Usefulness and focus of other studies is not as clear.

Geographic coverage: Land use studies are concentrated in Northeast and are very thin elsewhere. Public forest management and outdoor recreation studies are heavy in the Mountain States and West--there is need for more recreational studies oriented in Western U.S.

Problem coverage: The focus is almost entirely on State or smaller area problems with very little coverage of Federal Government's powers or policy options. Land use studies do not deal with most recent developments--purchase and lease back, easements, agricultural districts. There is little coverage of multicounty or regional planning districts, other special districts, governments, etc. Commercial agriculture is included in only one study.

C. Processes and Procedures for Land Use Planning

(CRIS: 90 projects, \$1.7 million, 35.6 SMY)
(SSIE: 42 projects)

Studies from the CRIS retrieval included in this category are directed toward devising and evaluating methods by which information for land

use planning can be assembled, and developing procedures for public decisionmaking related to land use planning. Two-thirds of the studies focus on the planning process, ranging from establishing criteria for delineating planning areas to developing evaluation techniques to measure the consequences of alternative plans. Most of these studies are oriented to area economic development planning, which bear on land use, or water and related land planning. Ten studies are designed to improve soil interpretations and socio-economic criteria for land use planning. Ten studies are oriented to developing systematic techniques for identifying and measuring environmental effects of resource use plans. Another eleven studies are underway to improve the planning and management of lands for recreation uses. Nearly all of these studies are intended to be useful to analysts and planners at either the **State** or substate area level.

Approximately half of the SSIE studies by non-USDA/Land Grant University research groups are addressed directly to improving land use planning procedures. The National Science Foundation sponsored a workshop on research needs for land use planning. Other studies range from developing systems for designing land use plans to meet community development objectives, to developing urban planning gaming-simulation models. Nearly half of the studies focus on developing procedures to improve water resource planning. The major emphasis of these studies is focused on developing planning systems and procedures that are applicable at the local area and substate level.

Nearly all of the studies included in this category have either direct application to land use planning or can be readily adapted. Additional studies are needed in developing techniques to incorporate local participation in the planning process. Procedures for measuring economic consequences of alternative plans are quite well developed. More attention should now be directed toward techniques for measuring environmental effects.

D. Land Use Program Alternatives

(CRIS: 18 projects, \$0.5 million, 7.9 SMY)
(SSIE: 2 projects)

Over one-third of the studies are concerned with economic problems in the management of water and watersheds. These studies examine economic activity related to river basin planning and other water development; economic benefits from multiple use of water and related land resources; economic evaluations of land management practices designed to increase water yield; effect of natural resource investments on growth of an area in employment and income; and comprehensive planning for urban storm-water systems. Studies also are underway on the role of forests in open-space planning;

changes in forest ecosystems in relation to changes in population, public and corporate policy, and pressure for goods and services; alternative growth paths for rural development; land retirement programs; farm estate planning; and public policy affecting use and management of range resources, roadside market sites, and dairy farming. Most of the investigations would be directly useful to land use planners. One of the studies is examining the problem of a region (nine Southwestern States); others are concerned with specific problems of a State or river basin, for example. The results of most of the investigations are broadly applicable.

In the SSIE files, only two studies on this topic were noted and both were funded by the National Science Foundation. One is concerned with a national environmental model of agricultural policy, land use, and water quality; the other with a regional analysis of grassland environmental systems including social, economic, and legal requirements, and rural-urban interactions which have major impact on land planning.

Much research is needed as background in the development of State legislation on land use policy. These studies would provide the framework for procedures that would consider the public's interest in all important decisions and actions regarding land use. For example, to what extent must property rights be modified to achieve desirable land use for the long term? What restraints need to be built into our framework of law and public administration to guide private decisions on land use?

DETAILED APPRAISAL OF EXISTING U.S.D.A. DATA 1/

1. Existing Resource Conditions

A. Soils

The data files contain information collected on soils, land use, and conservation needs of nonfederal lands; available laboratory test data for soil series; soil interpretations; soil descriptions; and soil taxonomy. The Conservation Needs Inventory (CNI) reports provide statistical data by county on the suitability of land for agricultural use and relates kinds of soils to cropland, pasture, woodland, and other land uses. Two data files provide data on the chemical and physical characteristics of soil series in the U.S. Two other files furnish soil interpretations (sanitary landfills, community development, resource material, crop yield potentials, water management, recreation and wildlife potential, etc.) that are useful for planning farm and nonfarm use of land. One file provides interpretations for soils in the U.S. while the other is for selected counties having completed soil surveys. The latter can be used to generate a graphic display of soil resources.

One file provides a list of all soil series in the U.S. and the extent of soil classification on a monthly basis, and still another accumulates soil description data. Both of these files are used in soil taxonomy.

Only two files are not automated. One of these files contains data on the presence or absence of pesticide residues in soil samples collected in 37 selected States. The other file provides laboratory data on soils of forest lands.

The CNI data are published. One-half of the data files are collected sporadically. Collection of data for the remaining files are spread evenly between decennially, monthly, annually, and cumulative update.

About 60 percent of the data are collected by SCS and one set each for ASCS, APHIS, and FS. Most of the data are from samples in selected locations. The CNI data were collected on a statistical random sample.

Data are lacking for an inventory of soil resources on urban and Federal lands. Also, data are lacking on prime agricultural lands, critically eroded lands, floodplains, and other fragile lands. All of the files are accessible but the file on soil interpretations should be completed as soon as possible so that complete data are available to land use planners.

1/ All data files summarized by the Office of Information Systems for the "Environmental Improvement Resource Development and Use" mission were reviewed and evaluated. In addition, other data files relating to selected goals of other USDA missions were reviewed. These included:

- (1) Farm Income
- (2) Agricultural Production and Marketing Efficiency
- (3) Agricultural Exports
- (4) Food and Nutrition
- (5) Consumer Services and Human Resource Development
- (6) Rural Development
- (7) Foreign Agricultural Development

B. Water

These files contain data on the hydrology of selected forest lands; reservoir parameters relating to location of sites, site specifications, and the quantity and quality of water stored; streamflow information; physical, chemical, and biotic properties of water stored; snow surveys and related climatological data; and water-related damage to rural lands.

Seven of the files contain data on the chemical and physical properties of impounded water and all of these relate the data to specific site locations. Also, one of these files includes data on potential impoundment sites and four contain considerable data on the parameters relating to potable water supply such as the type, storage, distribution, and treatment of water.

There is one file on snow surveys and another on streamflow. Both provide information on water yield, quality, runoff characteristics, and other related data.

All of the data are available but not published except for the file on potable water supply, type, storage, distribution, and treatment. About 70 percent of the files are manual and the data are not readily accessible except for the one that is published. One file is automated and another is partly automated.

About 70 percent of the data are collected by the FS. SCS collects data for two files and ERS and ARS have one each. All of the data are collected from selected locations scattered throughout the U.S. or on forest lands.

Additional data are lacking on the effects of solid waste and sludge disposal on lands; effects of solid, liquids, and gases generated by agriculture on water quality; and the effects of land use activities on water quality.

C. Timber

There are two principal sets of data files related to timber. One set relates to the acreage, location, and extent of forest lands and the other relates to disease and insect control and eradication.

Of three data files pertaining to forest land, one provides annual maps of regions, national forests, and national grasslands. The information is available in publications. A second and very extensive file contains estimates of commercial forest area, net growth, timber removals, and timber mortality by ownership class and county. The data are collected for State areas on roughly 10-year intervals and are available in either publications or through computer retrieval if more detail is requested.

Four of the files contain data by county, State, and other geographical regions on insects and diseases of forest. Also, one of the four

identifies areas infected and provides information on the number of parks and mobile home sites declared hazardous. The latter is published on a sporadic basis.

All of the files are collected by the FS and are manual; however, data are published for all but two of the files related to insect and disease control and eradication.

It may be desirable to collect the timber data on a more frequent cycle than the 10 to 12 years now experienced or to collect data parameters more directly keyed to economic profitability and competing uses.

D. Recreation Facilities

This group of data files concerns information on the physical nature and extent of recreation facilities. Data have been collected on size, location, capacity, operator, elevation, water relationship, access, and use season of forest recreation sites and associated areas by the FS. One file is collected sporadically and one on an annual basis. One is collected by geographic regions, and one relates to selected recreational sites. These last two data files are automated but the data are not published.

Similar data files are lacking on other recreational sites (private, county, State, regional, and national). The recreation facilities data would be most useful if related to soils, geology, topography, and other on-site resource data.

E. Pollution

The data files contain information on the effects of air pollution on forest trees, including the identification of acute and chronic symptoms of single or combined air pollutants from forest industries, refineries, smelting plants, and other industrial and urban sources. One file provides data on the amounts of air and other pollutants emitted from pulp mills and waste burners at sawmills. The frequency of collection for this file is unknown, but data for the other three are obtained sporadically.

All of the data are from the FS. Two of the files relate to selected geographic locations, but another is by geographic regions. The location of data from one file is not known. Information from one data file is published. Two files are manual; one is semi-automated, and the mode is not known.

Data are lacking on the effects of pollutants on other vegetative covers.

F. Wetlands

There is one data file with wetlands as a principal subject. This file, collected by ASCS on a one-time basis, provides information on wetland types 1 through 5 (seasonally flooded basins or flats, fresh meadows, shallow fresh marshes, deep fresh marshes, and open fresh water). The data are from selected geographic locations and are available by manual retrieval from office records.

G. Surface Mining

Only one data file contains data relating to the location, extent, and condition of resources available. The file provides information on the potential uses and reclamation possibilities (treatment needs) of surface-mined areas. The data support other resource oriented programs.

The data are summarized annually and are not published or automated. SCS collects the data.

Data collected could be a part of a resource inventory program designed to gather land cover and land use data. There is a lack of data on the changing extent, location, and condition of the surface-mined areas.

2. Production and Marketing of Land Products

A. Crop Production, Consumption, Marketing, and Prices

There are 56 types of data being generated on acreages, yields, processing, marketing, utilization, or prices of U.S. crops. Two of the data files compile information on the use of pesticides on selected crops. A large majority of these, 34, are developed by the Statistical Reporting Service. The Economic Research Service produces 9 and the Agricultural Stabilization and Conservation Service 5. The Census and other agencies account for the remainder. About a fifth provide information on a county basis, about half on a State basis, and about a fifth on a national basis only. A few are available only for selected areas. About 60 percent of the series are developed on an annual basis and about 20 percent monthly. A few are produced sporadically and the Census provides data every 5 years. Over 80 percent of the types reported are published. However, the remainder are available. Only 4 are automated. Most of the statistics are categorized as official estimates, although some are either inputs to or results of research.

Although some of the data are available on a county basis, data on crop acreages, yields, and other facets of production and marketing need to be available at this geographic detail to assist State and local land use planning. Also, a surprisingly small proportion is automated; hence, obtaining data from the agency holding it would likely be slow and costly.

B. Livestock Production and Marketing

Twenty-two data files contain information on inventories of major classes of livestock and poultry on farms, quantities of products produced, value of inventories and products, and farm income derived from livestock and poultry production. Ten files are primarily inventories of number of livestock and poultry and/or estimates of their physical production. This information is assembled annually on a State and national basis. Most of the data are accessible in published reports or available through manual examination of data files. These files are maintained by SRS and ERS. Twelve files are primarily devoted to assembling information on the volume and value of livestock and poultry products as they move through the processing and marketing channels. Products covered include red meats, poultry and eggs, dairy items, honey, and wool. Many of the files are compiled and published monthly, with annual summaries. Three files are available only on an annual basis. Production data on all commodities are generally assembled on a State basis. A few special files covering poultry and dairy products are maintained at the national level.

These data files and related published reports appear to be ample sources of information for relating livestock production to broad area land-use planning. However, additional data at the county level are needed for State and local area planning.

C. Wood Production

Information on the demand and supply conditions for forest products is assembled by the Forest Service in five data files. Demand statistics are estimated to indicate future demand for classes of timber and wood products in the United States. Supply statistics include information on forest areas, timber volumes and productivity, naval stores, and logging residues. One data file includes annual information relating to forest fires, including number of fires by area type, causes, and acreage burned. Supply data are compiled in annual summaries on a State, region, and national basis, while the demand data are estimated on a less frequent basis. All data except forest fire damage are available in published reports.

Information on supply statistics is needed on a more detailed geographic basis to serve State and local land use planners.

D. Recreation Use

Some data on the use of recreation facilities and characteristics of recreation users have been compiled. These data are distinguished from data concerning the physical extent of facilities contained in Section A 4, although some overlap exists. Information on recreation services available on National Forest lands has been assembled in

four data files. Data on the quantity and quality of recreation characteristics including environmental benchmarks, scenic quality, and experience levels, and carrying capacities are assembled on an annual basis but not published. A public information directory on the availability and use of Forest Service recreation facilities is published annually. Data on availability of recreation services are assembled on a regional basis.

Three data files contain information on the characteristics of recreation users of National Forest areas, including information on the visitor-day use attributed to recreation, fishing, and hunting. These data are available in annual summaries for selected locations, but they are not published.

Data files are needed to indicate the types of facilities, capacity, and location of recreation services provided by the private sector in rural areas.

3. Financial Conditions of Land-Based Enterprises

A. Farm Tax and Debt Information

Four data files are available concerning farm debts. They contain such information as the size of individual debts, who they are held by, and the interest rate paid. The data are assembled on an annual or biannual basis and are typically available only in manual form. One-half are available in published reports. Two data files pertaining to farm real estate taxes are collected annually and are available from ERS. One is readily available in automated and published form but one is not published.

Data on the existing tax and debt conditions of farms could provide information for programs relating to incentives for land use changes relating to real estate tax adjustments or credit inducements. Data on tax levels and indebtedness are lacking for non-farm land-based enterprises such as recreation developments or predominantly timber oriented firms.

B. Farm Labor Conditions and Other Input Costs

Six data files pertaining to labor productivity rates or inputs for the farming sector are available. All but one are provided by ERS on a State or geographic region basis in published annual summaries. Some are provided in a framework conducive to inter-regional and time-trend comparisons of farm labor productivity changes.

There are five data files containing information on itemized farm costs such as the factor input quantity and prices required for the production of various crops. Most of the data are collected by ERS and are available in published form in annual summaries of State geographic areas.

The labor data relate primarily to farms, and the input cost information is concentrated on crops and ignores livestock production. No data files pertain to non-farm outputs such as timber.

C. Farm Income and Real Estate Values

Ten data files were identified that pertain to farm real estate values. The data are available for different types of sellers and types of land sold, e.g., crop or grazing land. Most of the data are collected by ERS and some by SRS, and published as annual summaries of State areas. Some data are available from selected locations. That data are available but must be retrieved manually from unpublished sources.

Six data files pertaining to farm dwelling and farm land rental levels are available. Most are prepared by ERS as annual summaries of State-wide areas. Pasture rental values are available on selected localities from SRS but must be retrieved manually from unpublished sources.

Fourteen data files pertain to various aspects of farm income and economic well-being. The bulk of the data are collected by ERS and are available in published reports. The frequency of publication varies, and geographic scope of aggregation ranges from county and specific locals to the entire nation.

There is a rough balance of crop and livestock enterprise information but there is none on non-farm enterprises such as recreation and timber.

D. Farm Enterprise Characteristics

Six data files pertain to the character of farm enterprises such as the tenure of the operator, average farm acreage, and farm organization into family, partnership, or corporate structures. Three files pertain to the size and nature of farm production and marketing cooperatives. Some of the data are updated infrequently (5-year intervals) and the geographic scope of aggregation varies greatly from one file to the next. Census Bureau, ERS, and the Agricultural Stabilization Service have undertaken the data collection.

4. Public Program Formulation and Extent

A. Data Necessary for Farm Program Development

Data have been collected on land (capabilities, types, uses, use changes, competition for, etc.); agriculture and forest (production, supplies, diseases, genetic factors, exports and imports, etc.); recreational uses, needs, and planning; rural-urban interrelationships and planning; climate, ecology, and environmental aspects; farm and

other rural income; rural health; Federal and other program impacts; rural demography including ethnic group and income profiles; and rural development and planning.

About 80 percent of the data files are maintained manually; most of the remainder are automated. (Relationship of data volume to number of files is not apparent.) About half the data are collected on an annual basis and the remainder are primarily sporadic or on a cumulative update basis. About 10 percent of the files are automated but unpublished, 60 percent manual and unpublished, and about 20 percent published.

About half the data are collected by ASCS, FS, and SCS. The remainder are collected by other USDA, non-USDA, and miscellaneous groups. Collection methods include personal respondent reports, site surveys, questionnaires, and plot records. Data files are about 50 percent for selected locations, and most of the remainder are on a county, State, or regional basis.

One major gap is that many records are not readily accessible--i.e., manual records being maintained at a number of locations. Other indicated data gaps are in rural environmental needs and planning, land and land use inventories, recreation, and land use changes.

B. Nature of Credit Programs

This set of data files concentrates on the nature of public credit programs and contains such information as interest rates, borrower profiles, purpose of loan, and distribution. Geographical data collection is about equally divided between general regions, counties or States, and selected locations. About one-half of the data were collected by ERS and CMS as research input or for agency's use. The remainder were collected by various agencies.

Some data gaps appear to be better data on interest rates and charges, debt structure, off-farm income, and farm financing.

C. Nature of Various Types of Direct Assistance Programs

Data have been collected on matters such as need, recommendations, availability, extent, and costs of grants and cost-sharing for land and water conservation, environmental improvement, recreation, wildlife, forest improvements, rural and community planning and development, direct low-income assistance programs, and racial ethnic profiles of aid recipients. Most of the data are collected on an annual basis, with some collected on a sporadic or one-time basis, and the rest at more frequent intervals. About half the data relate to selected sites, and most of the rest to counties, States, or regions. Some data are collected for the U.S. and selected foreign areas. About 10-15 percent of the data are published, about 60 percent are in manual

files, and the rest are automated. About half the data were collected by the FS and SCS, with most of the rest collected by other USDA agencies. However, some data are collected by other agencies such as HUD, HEW, etc.

One apparent problem is that of accessibility to data already in the file. Most of the data are maintained manually, and may be in scattered locations. Other data gaps or need for better data appear to be in food movement; demographic data on aid and grant recipients and rural populations; unemployment statistics for smaller political subdivisions; nutrition activities and education; and State and local food distribution agency profiles.

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